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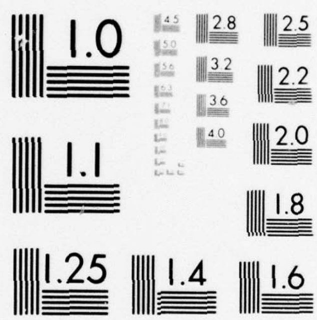

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

PROGRAM MANAGEMENT COURSE
INDIVIDUAL STUDY PROGRAM

THE MANAGEMENT AND CREATION
OF
STRATEGIC TECHNOLOGY OPTIONS

STUDY PROJECT REPORT
PMC 76-2

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FORT BELVOIR, VIRGINIA 22060

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE: THE MANAGEMENT AND CREATION OF STRATEGIC TECHNOLOGY OPTIONS

STUDY PROJECT GOALS:

1. To identify and assess the management organizations, strategies and techniques involved in the development of strategic technology options.

STUDY REPORT ABSTRACT:

The creation of options within the context of mission area planning has become a dominant management and investment strategy of the Department of Defense. This paper examines and illustrates the implication of this strategy in terms of organizational and management techniques for strategic research, development test and evaluation programs. This strategy is examined from the perspective of the Office of the Director Defense Research and Engineering, the DOD Components, and the Systems Program Office.

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THE MANAGEMENT AND CREATION OF STRATEGIC TECHNOLOGY OPTIONS

Study Project Report

Individual Study Program

Defense Systems Management College

Program Management Course

Class 76-2

by

Leland G. Fay
LtCol USAF

Study Project Advisor
David D. Acker

EXECUTIVE SUMMARY

The creation of options within the context of mission area planning has become a dominant management and investment strategy of the Department of Defense. This paper examines and illustrates the implication of this strategy in terms of organizational and management techniques for strategic research, development test and evaluation programs. This strategy is examined from the perspective of the Office of the Director Defense Research and Engineering, the DOD components, and the Systems Program Office.

The management and creation of technology options is demonstrated to be an effective strategy for the maintenance of the technological initiative in military hardware development. In this strategy the focus is shifted from full systems development to exploratory and advanced development where the goal is to develop a range of advanced system and technology options as a hedge against future threat uncertainties.

Although the stimuli for creating technology options sometimes comes from high planning and staff levels downward, in practice the program office often formulates the idea or concept from the technological possibilities or threat estimates based on the limits of advanced or hypothetical technology. Thus the Program Manager chartered with the responsibility for the creation of technology options must simultaneously (1) anticipate and develop counters for those

threats which could occur several years in the future (2) assess current and projected capabilities for technological limitations and (3) structure a time phased development program to provide a base for demonstrated solutions to these limitations and threat projections. This article reviews the various technology option programs and suggests several areas for special consideration and management attention if potential pitfalls to be encountered in accomplishing these three critical tasks are to be avoided.

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THE MANAGEMENT AND CREATION
OF
STRATEGIC TECHNOLOGY OPTIONS

> In order to avoid technological surprise, demonstrate the resolve to remain a major power, and provide a viable basis for future decisions, we must continually create a range of technological options and demonstrate their utility for weapon system application. If we fail to do this, or allow ourselves to lag behind our adversaries to any significant degree, we foreclose the future. Therefore, I consider the creation and demonstration of technological options to be the first priority of Defense R&D.
>
> Dr. Malcolm R. Currie
> Director of Defense
> Research & Engineering

INTRODUCTION

The creation of options within the context of mission area planning has become a dominant management and investment strategy of the Department of Defense. This paper examines and illustrates the implication of this strategy in terms of organizational and management techniques for strategic research, development, test and evaluation programs. This strategy is examined from the perspective of the Office of the Director of Defense Research and Engineering, the DOD components, and the Systems Program Office.

MANAGEMENT OF THE CREATION OF OPTIONS

Strategic force planning must take into consideration a number of factors including not only (1) the capabilities of

adversaries but also (2) the need to replace aging systems, and (3) to hedge against future uncertainties. Current technology does not permit delay of a selection of an appropriate counter until an opponent has developed and fielded an improved system. It takes 18 months to prepare a missile silo, approximately two and a half years to build a B-1, and around four years to construct a TRIDENT submarine. Faced with these lead times the U.S. must maintain a solid research and development program as a basis from which to create and retain a technological initiative. (2:45)

The basic DOD Research and Development (R&D) management and investment strategy to maintain the technological initiative has been outlined to Congress over the past several years. This strategy recognizes that the RDT&E program is constrained by resource limitations and does not allow adoption of every promising advance in technology. As a consequence, the strategy has two basic objectives: (a) the creation and demonstration of options that may be useful for future military capabilities and (b) the full-scale development of systems for potential deployment. The basic rationale is to create an initial range of technological options without investing too heavily in them, retain competing options to the point where further development involves major commitments, and conduct a demanding and thorough review before making an explicit decision to proceed with

full-scale development. In this strategy the focus is shifted from full systems development to exploratory and advanced development where the goal is to develop a range of advanced system and technology options as a hedge against future threat uncertainties.

From a management viewpoint these two objectives result in two quite different groups of programs. This program grouping is illustrated in figure 1.

Group I programs involve thousands of projects in the technology base plus specific system experiment and prototype demonstrations. These programs constitute Defense R&D budget categories 6.1 through 6.3. The management thrust in this group is to encourage innovation and initiative in creating and expanding the technology base and in investigating alternative systems. Development of new techniques and devices, feasibility demonstrations of competitive approaches, and prototype test platforms, characterize the activities of this group. The programs are often risky but are highly leveraged because the potential return from success is large compared to the investment. Typically the investment in this group covers about 40 percent of the R&D budget and is spread over many projects to hedge against uncertainties. Group I programs create and preserve a broad base of technological and system options from which to move rapidly into development in response to evolving threats or to capitalize on promising new technology.

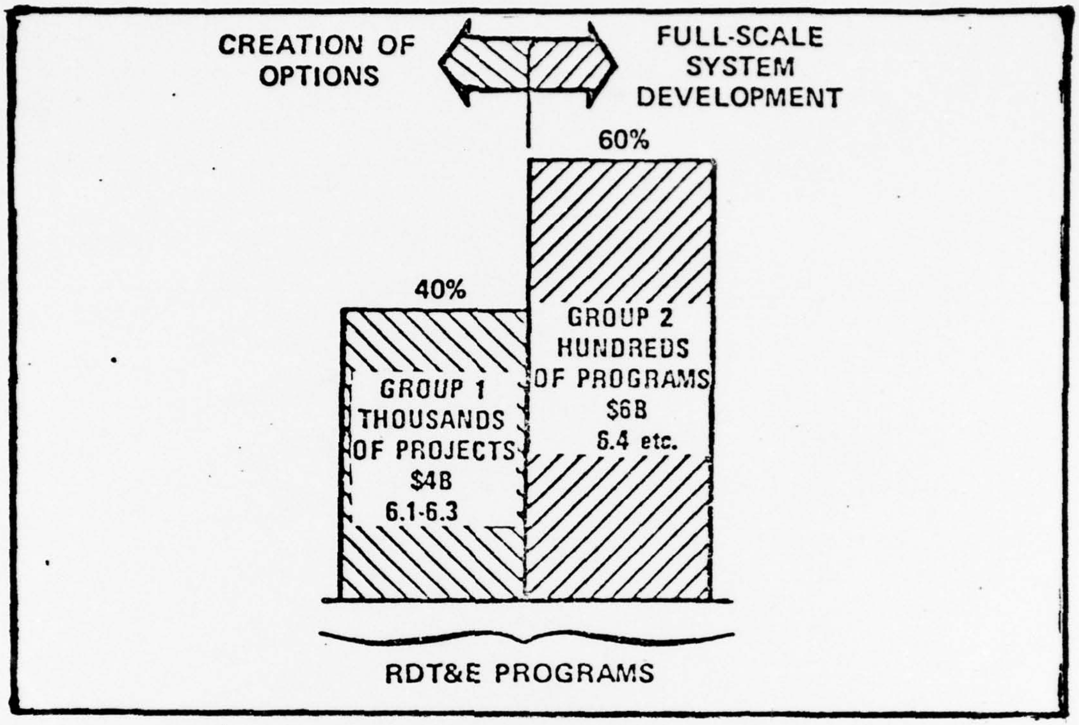


Figure 1 (22:248)

Group II programs embrace generally the R&D budget category 6.4 and encompass development of full-scale systems for potential deployment. Group II is characterized by engineering and operational development and involves construction of full-scale engineering models suitable for the combat environment and for test and evaluation by military personnel. Each program in Group II usually involves much greater cost than the prototype and technology demonstrations in Group I. This accrues from (1) the need to design to full military specifications, and (2) extensive test, evaluation, and support requirements. Upon entry into Group II the number of options is substantially reduced and major alterations in

the course of action become increasingly more difficult and expensive. In their aggregate full-scale development programs are much fewer in number, larger in cost and, when deployed, constitute a military capability for deterrence and war fighting. (22:247-253)

The transition from Group I to Group II programs represents a critical decision point in terms of the commitment of resources for full-scale development. Consequently competitive prototyping has become a key management and investment technique for the creation of options during the validation or advanced development stage of the Group I programs. This technique involves the combination of two management principles - competition, and the use of hardware demonstration to allow key decisions to be based on actual hardware experience rather than paper studies or theoretical predictions. Competitive prototyping is designed to motivate innovation and focus management attention on designing, developing, and delivering a superior product, not a superior promise.

The practical application of competitive prototyping for major systems is often limited by fiscal constraints: dual B-1 competitive prototyping would be prohibitively expensive. Consequently, before initiating new major development programs, tradeoffs are made between different means of satisfying new requirements: selecting previously developed subsystems and components, modifying an existing system, or using a system developed by a foreign ally. Alternatively, a dual development

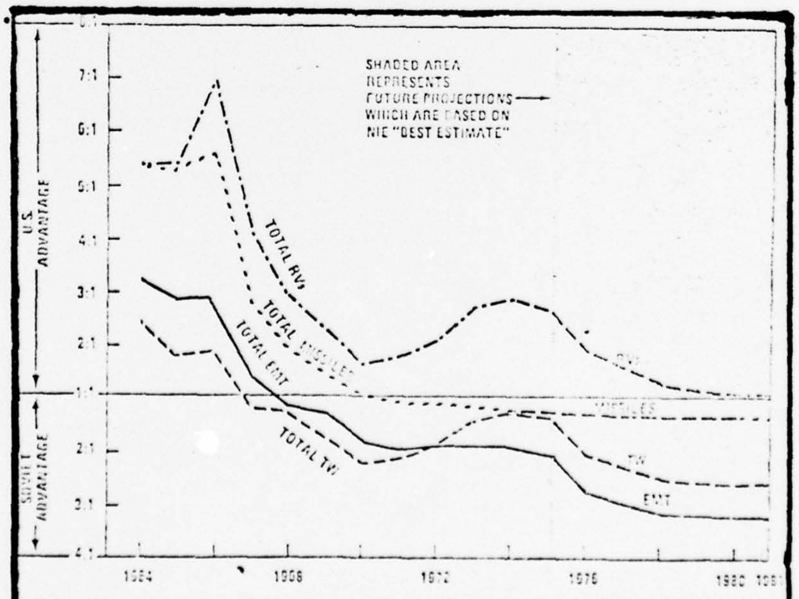
approach using combinations of these various means can be used to reduce development risk - modifications of existing systems in parallel with a new program can hedge against uncertainties and slippage in the new program. If both systems are successful and affordable the modified deployed system then becomes the low end of the high/low force mix. This force mix concept increases overall mission area effectiveness by providing larger quantities of lower cost, lower performance weapons to compliment the more sophisticated but less affordable high effectiveness weapon systems. (8:IX-13)

THE STRATEGIC ENVIRONMENT

In most areas important to national security, the United States till holds a lead in basic military technology over the Soviet Union. Current trends, however, indicate that the U.S. qualitative margin is being reduced by the U.S.S.R's extensive technological effort and deployment of new and improved weapons. Testimony by Dr. Currie, the Director of Defense Research and Engineering, before the 94th Congress emphasized that it was becoming increasingly apparent that the U.S. technological edge alone is not likely to be large enough in the future to offset the quantitative military advantages held by the Soviet Union. He testified that with a continuation and extrapolation of current trends in activity, investment, and achievement, the Soviet Union could achieve dominance in deployed military technology in the 1980's. (8:II-2)

Although a precise evaluation of the military technical balance is difficult to make, it is becoming increasingly apparent that the Soviets are working hard to gain the technological initiative. In the last decade the Soviets have developed 14 new offensive strategic missile systems. Significantly, more than half of the Soviet RDT&E effort for strategic offensive systems has appeared in the last three years where they have more than doubled their pace of the preceding seven years. Their success in enhancing their strategic forces and in creating a base for further improvements has been more pronounced than any other area of military R&D specialization. (22:244)

The net effect of the Soviet dollar investment and accompanying technical achievement can be seen by examining the U.S. versus Soviet growth ratios in strategic missiles in figure 2.



U.S./U.S.S.R. STRATEGIC MISSILE ADVANTAGE

Figure 2 (26:389)

Above the horizontal line shows the U.S. advantage and below the line it shows the Soviet advantage. The chart indicates essentially what has taken place with respect to the U.S. missile advantage. One can see that the United States has moved from the position of superiority to a position of rough equivalence or Soviet advantage. The top line shows total reentry vehicles; the next, total missiles; the next equivalent megatonnage and the final one is throw-weight. The chart does not include the U.S. bomber force in which the U.S. has a clear advantage.

During this same period the U.S. strategic budget has declined on the average at a rate of about five percent a year in real terms. This decline during the 1960's is from the $20 billion a year direct cost that was required for the initial acquistion of the current generation of strategic offensive forces. By FY 1976 only $7.3 billion was funded to cover the direct cost of developing, purchasing, and operating the strategic nuclear forces. This was the lowest level of funding (in constant dollars) for the strategic forces in the last 15 years. (See figure 3)

For FY 1977 the Department of Defense requested an increase to $9.4 billion to cover the direct cost of strategic nuclear forces. Beyond FY 1977 total direct funding for the strategic forces has been projected to grow at an annual rate of about three percent in real terms, primarily due to the requirement to modernize the current bomber and missile forces. However,

even with this overall increase of strategic funding levels the DOD FY 1977 request for strategic RDT&E represented a decreasing level of real effort. In constant FY 1977 dollars the DOD strategic R&D request for funding was less than that for FY 1976. (8:III-12)

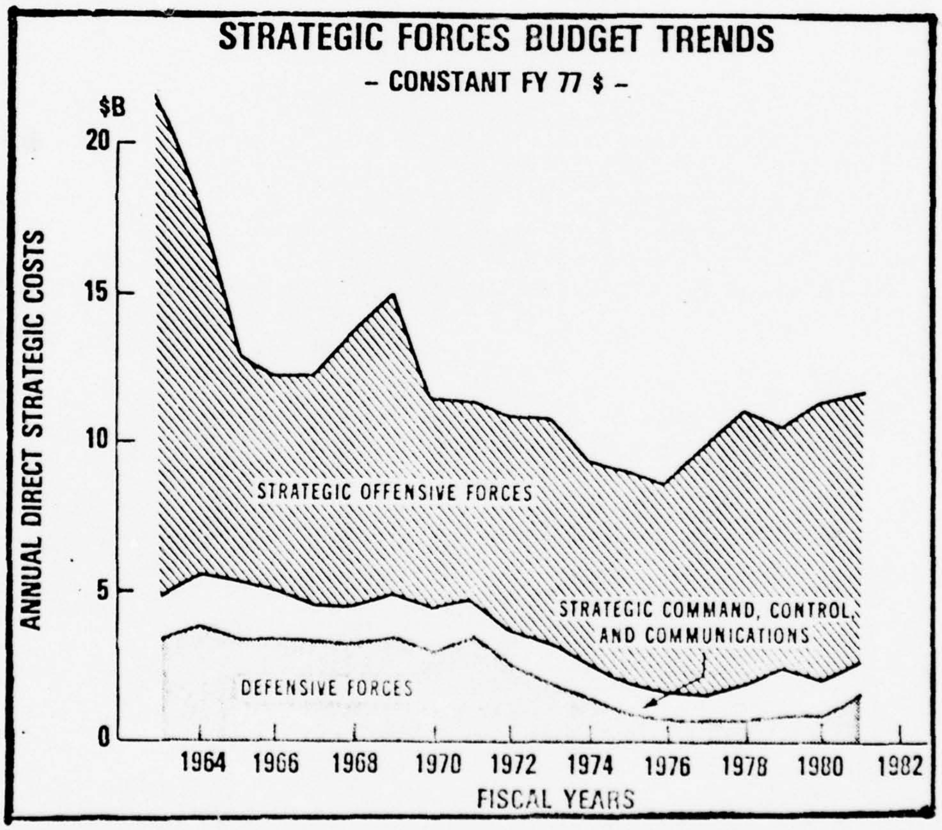
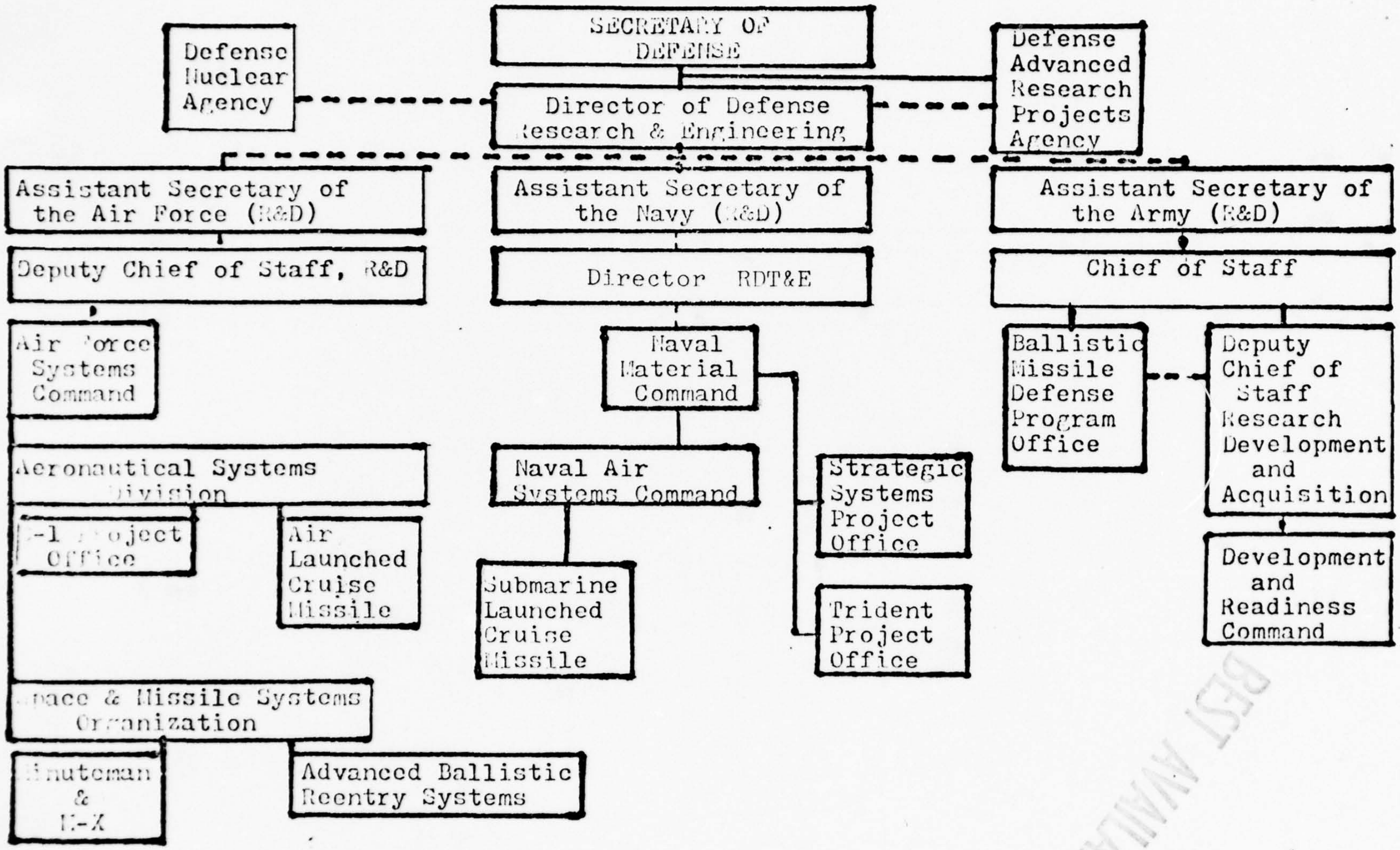


Figure 3 (26:56)

THE MANAGEMENT ENVIRONMENT

An understanding of the management and investment strategy outlined above is essential to the program manager who intends to function effectively within the strategic mission area. Equally important is a familiarity with the organizational and management environment within which the program must be managed. A review of DOD component organizations and programs within the strategic mission area reveals that the management controls and procedures used are quite diverse and depend on the stage of development within the RDT&E categories or the position of the system in the acquisition life cycle. All programs are included as program elements in the planning programming and budgeting cycle and those designated as major systems are managed through review and approval in the Office of the Secretary Defense (OSD). Programs that fall below thresholds that require OSD action are reviewed within or coordinated among the Military Departments or Defense Agencies.

The principal RDT&E organizations involved in the strategic mission area are shown in figure 4. The types of systems developed within these organizations include aircraft, missiles, reentry vehicles, submarines, space, communication, and radar systems - all of which support the strategic offense, defense, and command and control missions. DOD FY 1977 RDT&E funding in this area is $2.4 billion, of which two full-scale development programs - TRIDENT and the B-1 - account for more than one



R&D POLICY CHANNELS
Figure 4

half of the total. The remaining funds are allocated for the modification of existing forces or for programs to create options or hedges for the future. (8:I-17)

The strategic mission area is organized to permit the Director of DDR&E to exert centralized budgetary and technical control while requiring him to operate through the service R&D management structures. Figure 4 illustrates the R&D policy and technical review channels through which control is actually exercised. The dotted lines denote the official coordination path for program and budget decisions and represent direct paths of communication for technical review, while the heavy solid lines show command authority. Thus, while the Commander Air Force Systems Command reports directly to the Air Force Chief of Staff, policy guidance originates within the Office of the Deputy Chief of Staff for R&D on the Air Staff. Similarly each Assistant Secretary for R&D reports directly to the Service Secretary but works with DDR&E in the RDT&E policy area. Each service strategic program is essentially managed by a triumvirate: The Deputy Director DDR&E for Strategic and Space Systems, the service deputy for R&D, and Assistant Secretary for R&D from each service. The principal members of the service triumvirates are supported by Headquarters staff project officers and designated program managers who structure, direct and manage the approved programs. (13:51)

The Planning, Programming and Budgeting System (PPBS)

constitutes the framework for the planning, execution, and funding of strategic mission area programs. All DOD resources are segregated into major mission and support categories which become the ten DOD programs of the Five Year Defense Program. These ten programs are constructed of individual numbered program elements which constitute the building blocks for decision-making and resource allocation. The strategic mission area consists of the first DOD Program for Strategic Forces plus strategic development program elements included in DOD Program six for Research and Development.

Figure 5 outlines the PPBS in which all defense programs, including strategic mission area programs, are structured and managed. The system integrates the Joint Strategic Planning System force objectives documents with OSD guidance and decision memoranda concerning defense objectives, programs and funding. Program approval for inclusion in the Presidents budget to Congress is essentially an exercise in advocacy with numerous in-depth reviews and extensive dialogue on key issues between the OSD staff, the Military Departments, and the Office of Management and Budget (OMB). The essence of this system is an iterative process where the OSD staff reviews, analyzes, and recommends or directs changes to the program and budget proposals submitted by the DOD components.

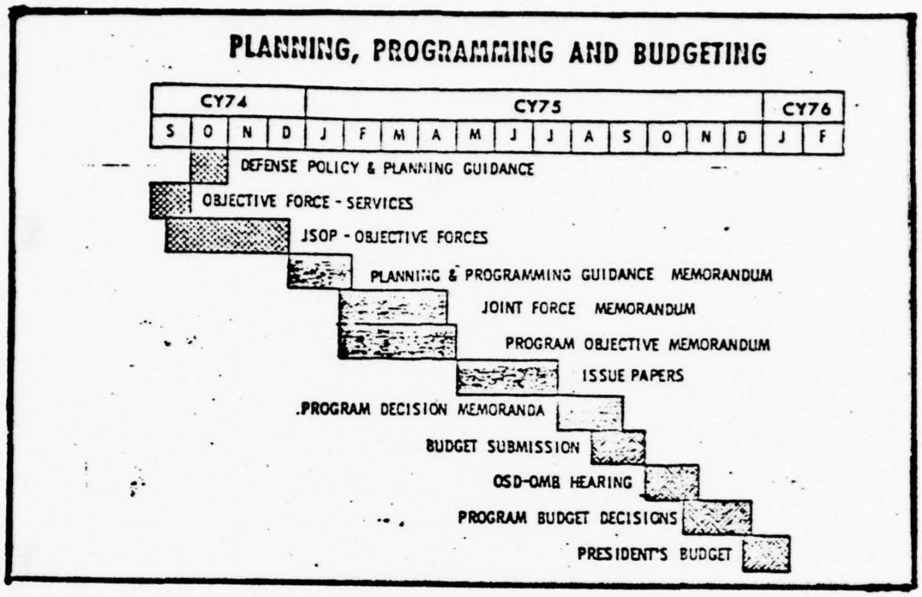
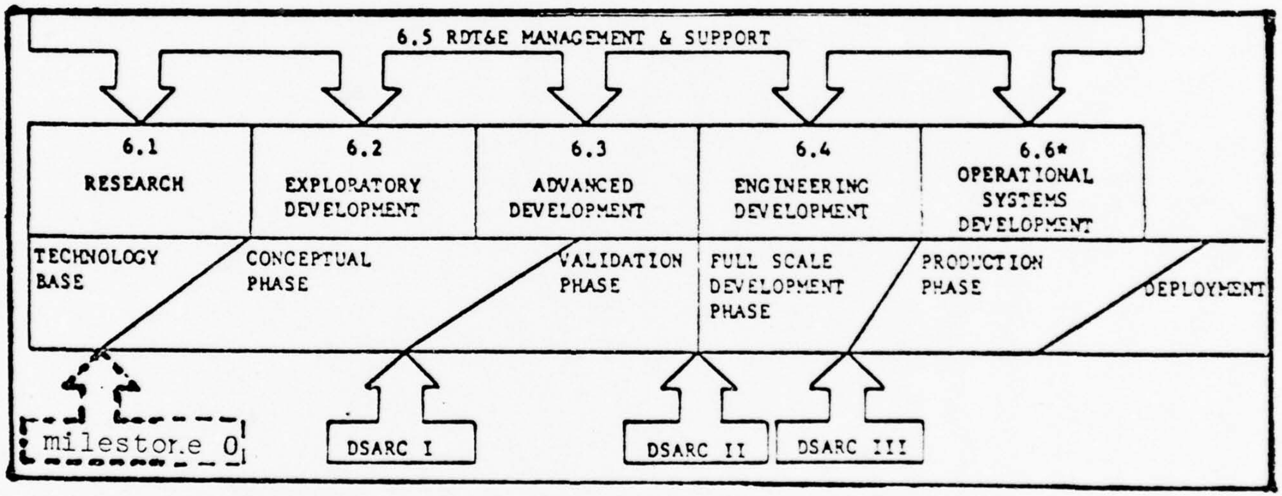


Figure 5 (26:1123)

Complimenting the PPBS is the decision-making process for approval of individual major weapon systems development - the Decision Coordinating Paper/Defense Systems Acquisition Review Council (DCP/DSARC) procedure. In this procedure, the Review Council principals are the Director of Defense Research and Engineering, the Assistant Secretary of Defense (Comptroller), the Assistant Secretary of Defense (Installations and Logistics), and the Assistant Secretary of Defense for Program Analysis and Evaluation. These principals, sitting as the Defense Systems Acquisition Review Council, make a recommendation concerning the next phase of the program to the Secretary of Defense for a decision, based upon the presentation by the program manager and the Service-approved Decision Coordinating Paper. Under the current decision-making procedures, the military need or

requirement is validated at the OSD level by the Review Council as the program passes into the validation phase (DSARC I), and again at the program decision points for the full-scale development and the production phases (DSARC II and III).(14:93) A correlation of these decision points with the acquisition life cycle and interrelated RDT&E categories is shown in figure 6.



LIFE CYCLE/RDT&E INTERRELATIONS

Figure 6 (16)

The DCP/DSARC process involves decision making at the Secretary of Defense level on major system acquisition programs. These have been defined by DOD directive as those programs having national urgency, an estimated RDT&E cost in excess of $50 million, or an estimated production cost in excess of

$200 million. Recent proposed changes to DOD policy directives indicate the intent to create a Milestone 0 and a Service System Acquisition Review Council (S)SARC to compliment the Defense Systems Acquisition Review Council. Under the new directives a DSARC level review would be conducted at Milestone I only for those programs classified as strategic or nuclear, joint service or multi-national, or command, control and communications, or intelligence. All other programs would be reviewed by the Service SARC at Milestone I; Milestone II and III reviews would continue to be conducted by the DSARC unless delegated by the SECDEF. (7)

Under the proposed changes the initial decision point in a major systems program would be at Milestone 0. Each DOD component would be responsible for initiating and conducting a continuing series of analysis to identify capability deficiencies that might arise from a changed threat, a technological opportunity, or an opportunity to reduce life cycle cost. After identification of a system level need, the DOD component would submit a mission element need statement and request Office of the Secretary of Defense (OSD) approval to enter into exploratory development. Smaller programs would follow the same general approach and philosophy as a major system but Milestone review and approval would continue to be accomplished by the DOD Component or through Program Memorandum submitted for OSD approval.

Perhaps the most important OSD management technique is what could be labled the "executive steering strategy". It is essentially the management initiatives and climate created by the personal influence, expertise, and insight of the people in ODDR&E and the military departments. The strategy actively supports the search for alternatives and options with a climate that welcomes rather than scorns new ideas and perspectives.(1:15) The flow of creative expression is energized through an iterative management review process and dialogue at the working level - between the ODDR&E professional staff specialists, the project monitor on the Military Department Staff and the program managers and technicians in the field organizations. The steering strategy essentially provides checks and balances, and encouragement within an "advocacy" environment. (12) It is founded on expertise in the technical disciplines of requirements analysis, technology assessment and program management.

ODDR&E has placed emphasis on the consideration of mission needs and has developed Mission Area Summaries and Technology Area Descriptions to review programs and promote alternative approaches. These documents are evolving management tools designed to assist ODDR&E in coupling their efforts with such new management initiatives as the mission area budget reviews recommended by the Commission on Government Procurement. They are essentially summary contextual references of the RDT&E program which highlight area objectives and deficiencies in

technology, intellegence and material across institutional and organizational lines. The documents essentially focus and synopsize the scope and complexity of the total RDT&E program so that management and review can be facilitated within mission areas. (9:V)

DOD COMPONENTS

The goal of Group I programs is to demonstrate basic technological or system feasibility in order to preserve the option to go forward at a later time should circumstances dictate. The work of the various DOD components in formulating and developing these technology base or advanced development programs provides the foundation for the management and creation of options strategy. Examples of research, exploratory and advanced development programs in this Group include: M-X which is addressing fundamental technology, TRIDENT II which is presently a conceptual system, and the air and sea launched cruise missiles (ALCM and SLCM) both of which are in advanced development.

Each DOD component is responsible for the initial formulation and execution of its own technology base program. Overall supervision of the service technology base is performed by the DDR&E Deputy Director for Research and Advanced Technology and a staff of senior technical personnel whose professional education and experience match key technology management areas. Integration of this technology base into the strategic mission

area is accomplished through both formal and informal coördination within ODDR&E.

A key contributor to the strategic technology base is the Defense Advanced Research Projects Agency (DARPA) which functions as a corporate level research laboratory for the Secretary of Defense. The DARPA mission is to generate major new thrusts in technology by undertaking speculative high risk/high payoff technology programs. Under DARPA's management a concept is carried to the point where it is judged to be feasible and then turned over to the interested DOD component for further development. This technology transfer is facilitated by the fact that DARPA contracts are administered by the contracting organizations of the three services with a view to service technical capabilities and eventual program transfer. (15:96)

DARPA's principal management relationship is with the Director DDR&E for program review and for coordination of service programs. In a similiar manner the ODDR&E exercises staff supervision and program funding approval over Defense Nuclear Agency efforts associated with nuclear testing and weapons effect research programs.

The Army's principle contribution to the Strategic Mission Area lies in the Ballistic Missile Defense (BMD) Program Office. The BMD Program Manager is assigned within the Office of the Chief of Staff, U.S. Army, as the principal assistant and staff advisor to the Chief of Staff and the Secretary of the Army for all matters pertaining to Ballistic Missile Defense.

The Program Manager exercises executive authority over the BMD program and staff supervision over Army staff elements for the planning, direction and control of the BMD program.(11) The two current major programs focus on R&D activity as a hedge against a Soviet technological lead that might encourage an abrogation of the ABM treaty.

The first program, the Systems Technology Program, addresses key issues involving the integration of complex BMD subsystems into responsive operating systems. The purpose is to understand and demonstrate the interaction between subsystems, overall command and control, and real time allocation of system resources. This task is a technologically demanding and critical portion of BMD development.

The second major effort - the Advanced Technology Program, is a broad based R&D effort to develop new technologies and foster improvements in conventional components for future BMD systems. Major research efforts are conducted in the areas of interceptor missiles, radar and optical sensors and data processing. Field test experiments are an essential part of this program where the current emphasis is on the search for revolutionary concepts and ideas which could yield technical breakthroughs. (2:71)

The Navy's Strategic Systems Project Office (SSPO) and the TRIDENT Project Office are designated project offices reporting directly to the Chief of the Naval Material Command. The Director of the SSPO also serves as the program manager

for the fleet ballistic missile program. (25:5315)

The need to ensure the continued survivability and operational effectiveness of the operational Sea Launched Ballistic Missile (SLBM) force and the requirement to provide an orderly replacement of the existing force after 1985 has led the Navy to consider numerous alternative SLBM technology options. These include the conversion of the Poseidon submarine, the TRIDENT submarine, and the longer range TRIDENT I missile. Several Group I programs are also included in the Navy's strategic RDT&E program. The first, the improved accuracy program, is a new strategic initiative by the Secretary of Defense in FY 1975 to establish the feasibility of potential SLBM strategic weapon system accuracy improvements. The second, the MK500 advanced development maneuvering evader reentry vehicle, was included in the TRIDENT I weapon system development program. As a hedge against future threats, current planning encompasses a sustaining program to maintain MK500 reentry vehicle technology and to conduct flight tests to assure compatibility with the TRIDENT I missile. This retains a low cost option to begin engineering development of the MK500 should a large deployment of a limited performance Soviet ABM system materialize.

A third option, the Navy's Sea Launched Cruise Missile (and the Air Force's Air Launched Cruise Missile) will remain in advanced development until the cruise missile concept has been satisfactorily demonstrated. Strategic cruise missile

technology is well in hand for components and subsystems but has not yet been integrated into a functional whole which demonstrates proof of concept. Here the advantage of the technology option concept is quite clear. In the advanced development stage expenditure levels are sufficiently low that the U.S. can afford to keep several viable options open. The real system cost and performance can then be demonstrated in a competitive environment before a decision to enter engineering development is made. (2:65-69)

Support of the Strategic Mission Area within the Air Force follows the established R&D organizational structure. Air Force strategic R&D programs are managed through individually chartered Systems Program Offices that report through technical product divisions to the Air Force Systems Command. Overall management control is exercised by the Deputy Chief of Staff Research and Development within the Air Staff. Aircraft related programs such as the B-1 Bomber and the Air Launched Cruise Missile are managed through Aeronautical Systems Division while missile and space programs are the responsibility of the Air Force Space and Missile Systems Organization. Current technology option programs are characterized by the M-X, Minuteman and Advanced Ballistic Reentry Systems (ABRES) Program Offices. The main thrust of the M-X program is the development of new technology to ensure the availability of a realistic option for the modernization of U.S. ICBM forces in the 1980's and beyond. Key technical objectives include

development of a guidance system needed to provide a high confidence capability for accuracy in transportable missiles. This effort includes design, fabrication, and testing of a preprototype guidance set capable of operating from multiple aimpoints and an advanced computer with the potential for significantly lower unit cost. Also being pursued is the development of new rocket motor technology, including the design, fabrication, and testing of lightweight motor cases, more efficient nozzles, and higher performance propellants in order to achieve the greatest amount of throw-weight per pound of propellant. For the Minuteman force the development of the MK-12A higher yield reentry vehicle is continuing in order to provide the option to improve force effectiveness by providing increased confidence in the ability to destroy any given target. Current efforts are keyed to a future production and deployment decision. Other R&D efforts include a silo hardness upgrade to improve overall force survivability and system accuracy improvements to achieve greater individual reentry vehicle utility. (2:63)

THE ABRES PROGRAM

The Advanced Ballistic Reentry Systems Program is a tri-service program managed by the Air Force as the executive agent. It was chartered in 1963 by the Director DDR&E to provide a combination of reentry vehicle configurations, penetration aids and reentry technology to ensure successful

reentry of U.S. strategic missile systems. ABRES is managed through the Headquarters Space and Missile Systems Organization and the Air Force Systems Command. DDR&E is responsible to establish the general scope and priorities of the program and neither the scope of the approved program nor the RDT&E resources allocated to it can be reduced by Air Force action without DDR&E prior approval. ABRES is formally reviewed by DDR&E in considerable detail twice a year after which both the technology programs and level of funding are approved. General and specific guidance is subsequently issued through Air Force Program Management Directives. (4)

ABRES does not fit the usual definition of a System Program Office, but rather is composed of numerous separate projects consisting of 30 to 40 new contractual efforts each year. Hardware is developed in support of technology advancement, not as an end item for the service operational inventory. The Program Office is organized to ensure quick responses to new technical requirements or intelligence information, and provides a flexible management approach for multiple path technology development and testing. These result in methods of hardware demonstrations, program formulation and management techniques typical of the task of creating advanced technology options. (20:I-1)

ABRES embodies the primary objective of an advanced development program - bridging the gap between new technology and operational hardware. This starts in the initial planning with the formulating of the program's objectives and analysis

of potential hardware applications, and continues to the end of the program, with the final demonstration of technical feasibility. ABRES projects can have different purposes or even combinations of purposes. Consequently, the scope and size of a project varies greatly - from relatively inexpensive technology programs to multi-million dollar subsystems demonstration programs.

ABRES projects are usually intended to prove that a specific function or group of functions can be performed with appropriate hardware in a realistic environment. The key question to be answered is how far should the program go in creating demonstration hardware versus how far should the program go in simulating or introducing the hardware to an actual operational environment. The extremes are realistic prototype hardware tested under totally duplicated operating conditions, on the one hand, and shelf items tied together and tested only to demonstrate critical functions, on the other. The first approach will achieve the highest level of confidence in the technology under consideration, but can be very costly and time consuming. The second is the least expensive, but may fall far short of establishing the worth of the technology. Experienced engineering judgment is necessary to minimize the required investment while at the same time providing proof that critical components can proceed directly to full-scale development. (3:2-1-10)

Program formulation activities at DDR&E level have their counterpart in the manner in which the ABRES program is

conceived, scrubbed down, and presented in final form to higher headquarters for approval. Each year teams of ABRES Project Officers and Engineers are formed and instructed to develop shopping lists of technology programs they propose for support in ensuing years. This is essentially accomplished by developing a list of promising reentry systems which have survived first-order system and requirements analyses and determining advances in technology required to achieve them. At the same time a corporate level ABRES Planning Group evaluates the current threat, the status of technology, and the estimated budget levels, and sets up a system of priorities for rating technology programs. The ABRES Program Director and the Planning Group then adjudicate between the competing programs being advocated to structure an integrated program within anticipated funding levels.

This interaction of technology and requirements is an intricate, iterative process. There is a synergistic effect between "requirements pull" and "technology push" in establishing and structuring new programs. A formal analysis and definition of requirements cannot be the genesis and beginning of all thinking: a new idea or concept cannot be separated from the technology that makes it possible. The management structure must encourage innovation while balancing formal system and requirements analyses with the evolving technological possibilities. (21:17)

This synergistic effect between requirements and technology

is a fundamental determinator of the nature of the strategic technology options program. The effects of this interaction cuts across organizational lines and impacts the various other technology programs within the strategic mission area as well as the competitive technological initiatives program with the Soviet Union.

The offense-defense interaction between ABRES and the Army's Ballistic Missile Defense Program Office (BMDPO) illustrates this requirement - technology synergism. Each organization benefits from the technology and requirements perspective of the other. The BMDPO is heavily dependent for a solution to the defense problem on understanding what a potential adversary can do. ABRES must understand what a competent defense can do and benefits from a whole spectrum of reentry physics, and radar discrimination and clutter data collected by the defense community.

Although there is a great deal of interplay between the two programs, both sides benefit from working on the offensive and defensive sides separately. The programs are coordinated by the Deputy DDR&E for Strategic and Space Systems but a spirit of friendly competition and cooperative effectiveness evaluations of system concepts and designs creates a climate of challenge, innovation, and operational realism.

Both the ABRES and BMDPO programs provide a technical base for intelligence assessments of Soviet offensive and defensive capabilities. To understand what the Soviets are

doing the U.S. must maintain a technological effort to make that analysis possible. New concepts and technology options can then be developed and demonstrated against a mirror image of U.S. technology and systems or in response to intelligence observations of Soviet R&D. These demonstrated technology options can then be "put on the shelf" and serve as a hedge against future Soviet technical advances or system deployments. The end result is a 4-5 year reduction in development lead time and the maintenance of the technological initiative. (25:5287,5632)

Since U.S. R&D programs are an open book to the world the existence of these programs has a direct impact on the ability to negotiate a position within the Strategic Arms Limitation (SALT) environment. R&D programs are bargaining chips not in the sense that they are done only for that purpose, but in the sense that a vigorous but prudent set of technology programs in the strategic area are taken into consideration and are powerful motivators in the negotiation process. A prudent level of demonstrated strategic technology is necessary to maintain a position with the Soviet Union. Consequently strategic RTD&E planning takes into account SALT agreements, but ODDR&E does not plan its forces and hence spend more or less primarily to obtain SALT agreements. (26:427)

IMPLICATIONS FOR THE PROGRAM MANAGER

The option creating strategy provides a catalog of

demonstrated technology projects or advanced prototypes that can be rapidly moved into full-scale development and deployment if the need arises. This need can materialize from a requirement to counter a validated threat projection, to correct a force deficiency, or to provide a new or improved operational capability.

Although the stimuli for creating technology options sometimes comes from high planning and staff levels downward, in practice the program office often formulates the idea or concept from the technological possibilities or threat estimates based on the limits of advanced or hypothetical technology. Thus the Program Manager chartered with the responsibility for the creation of technology options must simultaneously (1) anticipate and develop counters for those threats which could occur several years in the future (2) assess current and projected capabilities for technological limitations and (3) structure a time phased development program to provide a base for demonstrated solutions to these limitations and threat projections.

A review of the various option programs suggests several areas for special consideration and management attention if potential pitfalls to be encountered in accomplishing these three critical tasks are to be avoided.

First, the Program Manager must ensure that the technical expertise of the program office adequately covers the three critical tasks and technical disciplines involved - threat and requirements analysis, technology assessment and program

management. Designated project officers within the program office must not only have extensive technical experience in engineering design and test, but must have the capability to function as "mini" program managers for separate development contracts. This implies training similar to that offered at the Defense Systems Management College for company grade officers where the emphasis is on a balance of cost, schedule, performance and requirements. In addition, personnel with specialized experience in technical intelligence, systems analysis, and technology forecasting are required for a complete program management team mission capability.

Second, the option creating strategy appears best served when the three critical technical tasks are integrated in an innovative environment where new ideas and concepts are actively generated through a management policy of technical and system advocacy. The advocacy approach provides a means to generate the maximum number of alternative technical approaches and concepts as a base for extensive corporate level review and dialogue on the key technology and requirement issues.

Third, since in a demonstration of options strategy only one or a very few end items will undergo development testing, each test item or prototype must be fabricated with a high degree of perfection but represent a realistic operational design. This requires a balance of reliability, maintainability and producibility considerations. Demonstration of a technically feasible solution or concept that cannot be

economically produced does not result in a viable option for deployment. Similarly the test of a marginal design or the use of low quality components can result in test failures that seriously degrade the technical demonstration or data acquisition necessary to achieve program objectives.

Fourth, since there is no planned production in the usual sense, there is a need to ensure that an industrial base is maintained in key technology and production areas. This requires the use of sustaining contracts and development programs structured to keep key design and production teams productively employed. This is particulary critical in the face of declining defense budgets and in an industry already overburdened with idle production capacity.

SUMMARY AND CONCLUSIONS

The Office of the Director of Defense Research and Engineering assists the Secretary of Defense in directing and controlling the overall DOD program of research and development. DDR&E exercises centralized supervision but operates through the individual DOD component structure where R&D is actually performed or contracted. Each DOD component is responsible for initiating and conducting requirements analyses in order to identify deficiencies in capabilities and for assuring the development and maintenance of a technology base to support the service projected force needs.

The Strategic Mission Area planning presents all programs in an aggregated mission area partition so that they can be understood from an overall perspective. It provides an integrated picture of U.S. strategic programs together with the rationale for them. The Strategic Mission Area is supervised by the DDR&E Deputy Director for Strategic and Space Systems who advises the Director DDR&E regarding strategic military mission needs and specific development programs to meet those needs. The management task encompasses Group I and Group II programs and includes exploitation of the technology base, structuring specific system experiment and prototype demonstrations and full-scale development or modification of systems for deployment.

Within the Strategic Mission Area the management and creation of strategic technology options is a demonstrated,

effective strategy for the maintenance of the technological initiative in military hardware development. The management challenge is to ensure a full spectrum of choices generated from an environment in which new ideas and techniques are encouraged without a rigid tie to a specific deployment. A viable deterrent posture can be economically maintained by a parallel investment strategy that includes a modernization of U.S. strategic forces and a solid research and development program to hedge against future uncertainities. Within SALT and budget constraints the U.S. can retain the technological initiative through the use of demonstrated technology and system options that can be put "on the shelf" against future Soviet technical advances or system deployments.

DEPARTMENT OF THE AIR FORCE
Headquarters Air Force Systems Command
Andrews Air Force Base, DC 20334

Posted! 4 Dec 74

AFSC REGULATION 80-22

4 November 1974

Research and Development

AFSC REENTRY SYSTEMS PROGRAM

This regulation establishes AFSC policy for the Reentry Systems (RS) Program and assigns management responsibilities to the Deputy for Reentry Systems (D/RS), HQ SAMSO.

1. Terms Explained:

a. Reentry System. Any combination of reentry vehicle configurations, penetration aids, and related hardware designed to ensure successful completion of the strategic missile mission.

★b. Reentry Systems (RS) Program. The SAMSO program office consisting of Advanced Ballistic Reentry Systems (ABRES) and Support to the Services.

c. Advanced Ballistic Reentry Systems (ABRES). That portion of the Deputy for Reentry Systems (D/RS) Program designated as the DOD program for advanced development of reentry and penetration technology and devices. Although not a system program in the usual sense, ABRES will be managed in accordance with Air Force and AFSC 800-series publications

★d. Support to the Services. That portion of the RS Program designated to provide flight test support to Army and Navy programs as required and identified by the responsible Service. Funds required by the Air Force for this support are provided by the Army and Navy for their respective programs.

★2. Objectives. The RS Program includes appropriate technology programs assigned to HQ SAMSO (RS) and directly related portions of AFSC systems, programs, and projects in the research, exploratory development, advanced development, and engineering development programs throughout AFSC. The objectives are to:

a. Provide critical technology for successful reentry of our strategic missile systems.

b. Develop missile penetration system technology and advanced concepts to provide future engineering development programs, the options necessary to counter possible future ABM systems, to improve efficiency of our missile systems, and to carry out special missions to fulfill specified objectives

c. Provide critical reentry systems technology and alternate concepts to reduce technical and programmatic risks in current engineering development programs.

d. Identify and provide technical solutions to actual or potential deficiencies in reentry systems under engineering development.

e. Use the in-depth expertise in reentry technology and provide supporting functions to define and assess present or future foreign reentry systems' capabilities as required.

3. Coordination Policy:

a. HQ SAMSO (RS) is the mandatory coordination point for all reentry program related projects and will coordinate on:

(1) Proposals on programs or projects identified as related to the RS Program before they are submitted to HQ AFSC for approval.

(2) AFSC programs concerning reentry system hardening and survivability.

(3) Areas of technology related to ABRES throughout AFSC at the reviews described in paragraph 4e.

b. Differences between SAMSO and other AFSC organizations and program or project managers that cannot be resolved at the field command level will be referred by HQ SAMSO (RS) to AFSC/SDS for resolution or referral to higher authority

4. Deputy for Reentry Systems (D/RS) Responsibilities. D/RS is responsible for:

a. Managing the ABRES and Support to the Services programs.

b. Assessing potential and projected ballistic missile defense threats versus the state of reentry technology to ensure that the ABRES Program is structured to provide techniques that will ensure penetration of the defense.

★c. Assessing current and projected reentry system capabilities and requirements for technological limitations to ensure that the ABRES Program is structured to provide a base for solutions to those limitations

d. Supporting program managers in formulating the RS portion of their programs.

★e. Conducting semiannual reviews of the RS Program and related efforts with representatives of

Supersedes AFSCR 80-22, 8 Aug 72. (For summary of revised, deleted, or added material, see signature page.)
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Secretary of the Air Force, HQ US AF, participating commands and agencies, HQ AFSC, and the Director, Defense Research and Engineering (DDR&E) staff. These reviews will be used to analyze progress, verify overall program balance, ensure effective use of Air Force resources, ensure that future actions are based upon the need and technological state of the art, and recommend changes in participating commands' and agencies' assignments required to enhance project or program management.

f. Providing direct technological support to the Services' programs in the engineering or operational systems development phase. This support will be funded by the Service program involved.

g. Ensuring early submission of instrumentation and other support requirements in accordance with established range documentation procedures.

★**5. Relationships With Industrial Activities.** HQ SAMSO (RS) is encouraged to conduct annual reviews of the proposed program with representatives of the aerospace industry. The purpose of these reviews is to ensure that industrial activities responsible for formulating R&D programs obtain an understanding of the level of the Government's commitments to advanced reentry technology. These reviews should also help to ensure that DOD program funds (ABRES, DNA, and DARPA), independent R&D funds, and funds from other Government agencies and the private sector of the economy are expended in the most efficient manner.

6. Other AFSC Organizational Responsibilities. AFSC organizations doing work related to the RS Program will respond with appropriate documentation upon request by HQ SAMSO (RS).

7. Communication. Direct communication is authorized between HQ SAMSO (RS) and other AFSC organizations, major commands, military departments, and Government agencies on nonpolicy and nonposition matters pertaining to technical aspects of the program. All other communications will be directed to AFSC/SDS.

OFFICIAL

SAMUEL C. PHILLIPS, General, USAF
Commander

DAVID M. HUDACK, Colonel USAF
Director of Administration

SUMMARY OF REVISED, DELETED, OR ADDED MATERIAL

This revision reflects modifications to organizational and program terminology; deletes the Categories of Effort and Annual Review requirement; adds the responsibility for assessing projected limitations and the semiannual DDR&E review requirement; and revises objectives to reflect current program direction.

GENERAL ORDERS No. 12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, 22 May 1974

I..*SAFEGUARD SYSTEM ORGANIZATION*. Effective 20 May 1974, the SAFEGUARD System Organization is redesignated the United States Army Ballistic Missile Defense Organization, and the following are redesignated as indicated:

From	*To*
SAFEGUARD System Manager (SAFSM).	Ballistic Missile Defense Program Manager (BMDPM).
US Army SAFEGUARD System Office (SAFSO)--Arlington.	Ballistic Missile Defense Program Office (BMDPO).
US Army SAFEGUARD System Command (SAFSCOM)—Huntsville.	Ballistic Missile Defense Systems Command (BMDSCOM).
US Army SAFEGUARD System Evaluation Agency (SAFSEA).	(No change.)
(Newly established)	Ballistic Missile Defense Advanced Technology Center (BMDATC).

II..*BALLISTIC MISSILE DEFENSE PROGRAM MANAGER*. 1. Effective 20 May 1974, the Ballistic Missile Defense Program Manager is assigned within the Office of the Chief of Staff, US Army, as the principal assistant and staff adviser to the Chief of Staff and the Secretary of the Army for all matters pertaining to Ballistic Missile Defense. The Ballistic Missile Defense Program Manager, within the instructions issued by the Chief of Staff, will exercise Department of the Army executive authority over the Ballistic Missile Defense Program and the resources made available for its accomplishment, and will exercise staff supervision over all Army Staff elements and participating organizations for planning, direction, and control of the Ballistic Missile Defense Program.

2. He commands the United States Army Ballistic Missile Defense Organization.

3. The mission of the Ballistic Missile Defense Program Manager is to develop a coordinated program which insures the timely, effective development and operation of the SAFEGUARD BMD System, the cost-effective execution of the Site Defense prototype demonstration, conduct of energetic research and development in advanced ballistic missile defense technology, and management of the Kwajalein Missile Range as a National Range.

4. The Ballistic Missile Defense Program Manager will provide a single point of contact within the Department of the Army for the coordination and direction of Army activities pertaining to the Ballistic Missile Defense Program.

III--BALLISTIC MISSILE DEFENSE ADVANCED TECHNOLOGY CENTER. 1. Effective 20 may 1974, the Ballistic Missile Defense Advanced Technology Center is established at Huntsville, Alabama, as a field operating agency under the Ballistic Missile Defense Program Manager to conduct research in Ballistic Missile Defense advanced technology.

2. Concurrently, the United States Army Advanced Ballistic Missile Defense Agency—Huntsville, a field operating agency under the jurisdiction of the Chief of Research, Development, and Acquisition (see XII*b*, GO 10, 8 May 74) is discontinued and its personnel and resources transferred to the Ballistic Missile Defense Advanced Technology Center.

3. Concurrently, the United States Army Advanced Ballistic Missile Defense Agency—Arlington, a field operating agency under the jurisdiction of the Chief of Research, Development, and Acquisition (see XII*a*, GO 10, 8 May 1974) is discontinued and its personnel and resources transferred to the Ballistic Missile Defense Program Office pending further transfer of specific functions to the Ballistic Missile Defense Advanced Technology Center.

IV--GENERAL COURTS-MARTIAL. The Commander, United States Army Ballistic Missile Defense Organization is designated by the Secretary of the Army, pursuant to the Uniform Code of Military Justice, Article 22(a)(6), to convene general courts-martial effective 20 May 1974.

V--GENERAL COURTS-MARTIAL. The Commander, Ballistic Missile Defense Systems Command, is designated by the Secretary of the Army, pursuant to the Uniform Code of Military Justice, Article 22(a)(6), to convene general courts-martial effective 20 May 1974.

VI--APPOINTMENT OF COMMANDER. By direction of the President, Colonel Eugene R. Bauer, 495-22-5651, IN, is appointed as Acting Commander of the US Army Military District of Washington effective 3 through 13 June 1974.

VII--UNITED STATES ARMY AIR DEFENSE COMMAND. Effective 4 January 1975, the United States Army Air Defense Command, a major Army command under the jurisdiction of Headquarters, Department of the Army, is discontinued.

By Order of the Secretary of the Army:

CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

DISTRIBUTION:
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U.S. GOVERNMENT PRINTING OFFICE 1974

DOD PROGRAM ELEMENT CODE SYSTEM

Example: 63311F Advanced Ballistic Reentry Systems

DERIVATION	63311F
DOD PROGRAM	6
R&D CATEGORY	3
BUDGET ACTIVITY	3
SERIAL NUMBER	11
SERVICE	F

DOD PROGRAM

1. Strategic Forces
2. General Purpose Forces
3. Intelligence & Communications
4. Airlift/Sealift
5. Guard & Reserve Forces
6. Research & Development
7. Central Supply & Maintenance
8. Training, Medical and Other General Personnel Activities
9. Administration and Associated Activities
0. Support of Other Nations

R&D CATEGORY

1. Research
2. Exploratory Development
3. Advanced Development
4. Engineering Development
5. Management & Support

BUDGET ACTIVITY

1. Military Sciences
2. Aircraft & Related Equipment
3. Missiles & Related Equipment
4. Military Astronautics and Related Equipment
5. Ships, Small Craft and Related Equipment

BUDGET ACTIVITY (cont'd)

6. Ordnance, Combat Vehicles and Related Equipment
7. Other Equipment
8. Programwide Management and Support

SERIAL NUMBER

Advanced Ballistic Reentry Systems

SERVICE

- A Army
- B Defense Mapping Agency
- C Defense Civil Preparedness Agency
- D Department of Defense (OSD & OASD)
- E Defense Advanced Research Projects Agency
- F Air Force
- G National Security Agency
- H Defense Nuclear Agency
- J Joint Chiefs of Staff
- K Defense Communications Agency
- L Defense Intelligence Agency
- M Marine Corps
- N. Navy
- R Defense Contract Audit Agency
- S Defense Supply Agency

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